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Naprave in konstrukcije za prireditvene prostore in zabaviščne parke – Varnost

Fairground and amusement park machinery and structures - Safety

Fliegende Bauten und Anlagen für Veranstaltungsplätze und Vergnügungsparks - Sicherheit

Machines et structures pour fetes foraines et parcs d'attraction - Sécurité

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Fairground and amusement park machinery and structures - Safety

Machines et structures pour fêtes foraines et parcs d'attraction - Sécurité

Fliegende Bauten und Anlagen für Veranstaltungsplätze und Vergnügungsparks - Sicherheit

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 13814:2004) has been prepared by Technical Committee CEN/TC 152, "Fairground and amusement park machinery and structures - Safety", the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at the latest by June 2005.

This European standard has been prepared under the mandate M/233 given to CEN by the European Commission and the European Free Trade Association. A European Directive concerning fairground and amusement machinery does not exist.

This European standard forms part of a series of two documents prepared by CEN/TC 152 for fairground and amusement park machinery and structures. The other document is prEN 13782, “Temporary structures – Tents – Safety”

In its present state this European Standard may require, where mentioned in the different clauses, the application of national standards since some of the basic EN-standards to be used in applying this European Standard are not yet available. The content of this European Standard brings together the different existing national regulations and guidelines as far as possible.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The object of this document is to define safety rules related to structures and machines, which are either an integral part of, or constitute the amusement device itself. The safety rules are intended to safeguard persons against the risk of accidents caused by deficiencies in design, manufacture and operation of such structures and machinery. This document is based upon past experience and risk analyses.

Annex A is an informative part of this document providing guidance on the calculation of structural steel parts.

Annexes B and C are normative parts of this document giving detailed and necessary calculation or safety rules.

Annex D (normative) deals with electrical installations and control systems.

Annex E (informative) deals with guidance on passenger containment.

Annex F (informative) shows a typical layout of a log book for an amusement device.

Annex G (informative) Acceleration effects on passengers.

Annex H (informative) Provisions prior to use.

Annex I (informative) List of Hazards for amusement rides.

1 Scope

This document specifies the minimum requirements necessary to ensure the safe design, calculation, manufacture, installation, maintenance, operation, examination and testing of the following: mobile, temporary or permanently installed machinery and structures e. g. roundabouts, swings, boats, ferris wheels, roller coasters, chutes, grandstands, membrane or textile structures, booths, stages, side shows, and structures for artistic aerial displays. The above items are hereafter called amusement devices, which are intended to be installed both repeatedly without degradation or loss of integrity, and temporarily or permanently in fairgrounds and amusement parks or any other locations. Fixed grandstands, construction site installations, scaffolding, removable agricultural structures and simple coin operated children's amusement devices, carrying not more than two children, are not covered by this document.

Nevertheless this document may be used in the design of any similar structural or passenger carrying device not explicitly mentioned herein.

Existing national rules on workers' safety are not concerned by this document.

This document is not applicable to amusement devices which are manufactured before the date of publication of this document by CEN.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2, *Classification of fires.*

EN 3 (all parts), *Portable fire extinguishers.*

EN 286-1, *Simple unfired pressure vessels designed to contain air or nitrogen — Part 1: Pressure vessels for general purposes.*

EN 287 (all parts), *Approval testing of welders — Fusion welding.*

EN 288 (all parts), *Specification and qualification of welding procedures for metallic materials*.

EN 294:1992, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*.

EN 418, *Safety of machinery — Emergency stop equipment, functional aspects — Principles for design*.

EN 573-3, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition.*

EN 696, *Fibre ropes for general service — Polyamide*.

EN 697, *Fibre ropes for general service — Polyester*.

EN 698, *Fibre ropes for general service — Manila and sisal.*

EN 699, *Fibre ropes for general service — Polypropylene.*

EN 700, *Fibre ropes for general service — Polyethylene*.

EN 701, *Fibre ropes for general service — General specification*.

EN 719, *Welding coordination — Tasks and responsibilities*.

EN 729-2, *Quality requirements for welding — Fusion welding of metallic materials — Part 2: Comprehensive quality requirements.*

EN 729-3, *Quality requirements for welding — Fusion welding of metallic materials — Part 3: Standard quality requirements.*

EN 818 (all parts), *Short link chain for lifting purposes — Safety*.

EN 919, *Fibre ropes for general service — Determination of certain physical and mechanical properties*.

EN 954-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*.

EN 1050:1996, *Safety of machinery — Principles for risk assessment.*

EN 1176 (all parts), *Playground equipment.*

EN 1261, *Fibre ropes for general service — Hemp*.

EN 1418, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1677 (all parts), *Components for slings — Safety.*

EN 10025, *Hot rolled products of non-alloy structural steels — Technical delivery conditions*.

EN 10027 (all parts), *Designation systems for steels.*

EN 10083-1+A1, *Quenched and tempered steels — Part 1: Technical delivery conditions for special steels*.

EN 10084, *Case hardening steels — Technical delivery conditions.*

EN 10160, *Ultrasonic testing of steel flat product of thickness equal to or greater than 6 mm (reflection method).*

EN 10164, *Steel products with improved deformation properties perpendicular to the surface of the product — Technical delivery conditions*.

EN 10204, *Metallic products — Types of inspection documents*.

EN 12385 (all parts), *Steel wire ropes — Safety.*

EN 13411 (all parts), *Terminations for steel wire ropes — Safety.*

EN 13889, *Forged steel shackles for general lifting purposes — Dee shackles and bow shackles — Grade 6; Safety.*

prEN 14399 (all parts), *High-strength structural bolting for preloading.*

EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs (ISO 898-1:1999).*

EN ISO 4014, *Hexagon head bolts — Product grades A and B (ISO 4014:1999).*

EN ISO 4016, *Hexagon head bolts — Product grade C (ISO 4016:1999)*.

EN ISO 4017, *Hexagon head screws — Product grades A and B (ISO 4017:1999).*

EN ISO 4018, *Hexagon head screws — Product grade C (ISO 4018:1999).*

EN ISO 4032, *Hexagon nuts, style 1 — Product grades A and B (ISO 4032:1999).*

EN ISO 4034, *Hexagon nuts — Product grade C (ISO 4034:1999).*

EN ISO 5817, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2003)*

EN ISO 7090, *Plain washers, chamfered — Normal series — Product grade A (ISO 7090:2000)*.

EN ISO 12100-1, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*.

EN ISO 12100-2, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*.

EN 30042, *Arc-welded joints in aluminium and its weldable alloys — Guidance on quality levels for imperfections (ISO 10042:1992).*

EN 45004, *General criteria for the operation of various types of bodies performing inspection*.

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997).*

EN 60204-32, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:1998).*

EN 60947 (all parts), *Low-voltage switchgear and controlgear*.

EN 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1 : General requirements and tests (IEC 61496-1:1997).*

prEN 61496-2, *Safety of machinery — Electrosensitive protective equipment — Part 2 : Particular requirements for equipment using active optoelectronic protective devices (IEC 61496-2:-).*

EN 61558-1, *Safety of power transformers, power supply units and similar — Part 1: General requirements and tests (IEC 61558-1:1997, modified).*

ENV 1991-2-3, *Eurocode 1: Basis of design and actions on structures — Part 2-3: Actions on structures — Snow loads.*

ENV 1991-2-4:1995, *Eurocode 1: Basis of design and actions on structures — Part 2-4: Actions on structures — Wind actions*.

ENV 1992 (all parts), *Eurocode 2: Design of concrete structures.*

ENV 1993 (all parts), *Eurocode 3: Design of steel structures.*

ENV 1995-1-1, *Eurocode 5: Design of timber structures — Part 1-1: General rules and rules for buildings*.

ENV 1997-1, *Eurocode 7: Geotechnical design — Part 1: General rules*.

ISO 3755, *Cast carbon steels for general engineering purposes*.

ISO 6309, *Fire protection — Safety signs*.

ISO 7413, *Hexagon nuts for structural bolting, style 1, hot-dip galvanized (oversized tapped) — Product grades A and B — Property classes 5, 6 and 8*.

IEC 60364-4-41, *Electrical installations of buildings — Part 4-41: Protection for safety — Protection against electric shock.*

IEC 60364-5-54, *Electrical Installation of buildings — Part 5-54: Selection and erection of electrical equipment — Chapter 54: Earthing arrangements, protective conductors and protective bonding conductors*.

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety related systems.*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
amusement device
any ride, structure, textile, or membrane structure or device, side stall, side show, tent constituting part of a ride, booths, grandstands, etc. which can be installed repeatedly without degradation or loss of integrity as well as temporarily or permanently at fairs, parks or any other locations

3.2
independent inspection body
any independent organisation capable of carrying out third party review, approval, examination and tests of amusement devices

3.3
initial approval
design and calculation review, verification, examinations and tests executed by the independent inspecting body before a ride is first made available for public use

3.4
log book
book or file containing all the necessary information about the use and history of any amusement device, including its design and initial approval

3.5
permit
authorisation to operate an amusement device in a particular member state granted by the legally authorised body after successful approval or examination

3.6
independent thorough examination
procedures and investigations necessary for the independent inspection body to decide whether the amusement device is in such a condition that it can continue to be operated safely, or whether it requires defects to be remedied immediately or within a specified time

3.7
licensing body
any national authorities or bodies legally authorised to issue a permit for operation of an amusement device and its log book

3.8
modification
any alteration to the hardware or software of an amusement device, including the introduction of a new safety critical component or the substitution of a safety critical component, which results in a deviation from the design specification

3.9
repair
restoration of safety critical components or safety critical assemblies to an acceptable condition by the mending of worn, damaged or decayed parts, which does not result in a deviation from the design specification of the original parts

3.10
safety critical component
any type of component of an amusement device on which the safety of the passengers is dependent

3.11
passenger containment
components (for example seating, footwells, handrails and passenger restraints) designed to prevent passengers from moving outside a predetermined area on a ride either as a result of the ride forces or the behaviour of the passenger

3.12
passenger unit
part or parts of an amusement device in or on which the public is intended to ride

3.13
platform
horizontal or slightly inclined surface raised above the level of an adjacent area

3.14
operator
person appointed by the controller to be in charge of the operation of an amusement device at all times when it is intended to be available for the public

3.15
attendant
any person appointed to work under the control or direction of an operator, to assist in the operation of an amusement device available for use by the public

3.16
controller (ride controller)
person or organisation having overall control of an amusement device. This may be either an individual or corporate body owning an amusement device or the concessionaire or lessee who has been granted control of the device, by the owner, for a specified period

3.17
daily check
operational check made before the device is made available to the public, to determine whether or not an amusement device is in such condition that it may continue to be operated safely

3.18
trial run
proving run of an amusement device during which no passengers are carried

3.19
service
replacement or replenishment of components, including fluids which are designated to be replaced or replenished at specified intervals

4 Symbols

Any symbols connected with the respective units will be explained in the clauses concerned.

5 Common requirements for design analysis and examination

5.1 Design documents

5.1.1 General

The construction documents include all the documents required for the assessment of the stability and operational safety of the amusement device. They shall be provided for any subsequent approval by the independent inspecting bodies. These documents shall encompass all the design conditions pertaining to the operation of the amusement devices or structures. A description of the construction, operation and operational safety, design

drawings and a comprehensive stress, fatigue and stability analysis as specified in 5.1.4 are required for this purpose.

5.1.2 Description of design and operation

The amusement device, in particular its design, mode of utilisation and its structure shall be explained in this description. Adequate details of mechanical, (hydraulic, pneumatic) electrical and electronic equipment, including the control system shall be listed. The description shall include details of the particular features of the amusement device and of any alternative modes of installation which may exist. Also details of the main dimension and of motion spaces extending beyond these dimensions, limitations, design particulars and materials, motion systems, types of drive, velocities, accelerations, electrical equipment, work cycle and operating sequence and of any restrictions regarding the circle of users which may exist, shall be described.

5.1.3 Design and manufacturing drawings

These are required for all assemblies, subassemblies and individual components, the fracture or failure of which might endanger the stability or operational safety of the device. The drawings shall feature all the dimensions and cross section values required for testing and approval, including details of materials, structural components, fasteners, connectors, and also relevant velocities. The drawings shall include as a minimum:

— general drawings in plan view, elevation and sections, in a legible scale, depending on the size of the amusement device;

— indication of the necessary clearance around the moving parts;

— detail drawings showing all the structural subassemblies which are not clearly discernible on the general drawings, as well as detail drawings of connections and individual items of a structural, mechanical or electrical nature, which could affect the safety of the amusement device and its operation, shall be drawn to a larger scale;

— illustrations of the following items may be necessary for this purpose:

  — slewing gear, hoisting and swivelling mechanisms, including their support arrangements, drives and controls, lifting and swivelling ranges;

  — carriages, gondolas and similar, illustrated in all the required views and cross sections, with details of the overall dimensions, the internal dimensions of importance to the passengers (seats, side and back rests, leg and foot room), hand and foot holds and locking and securing devices;

  — motion gear with details of load, guide, and up stop wheels, bearings, axles, shafts and their attachment, liberty of movement in relation to the vehicle, steering and control, anti roll back devices, safety devices against derailment and overturning, buffers, trailer devices, protection devices, drives and brakes and anchoring to the foundation;

  — pneumatic and hydraulic circuits and electrical and electronic wiring diagrams.

5.1.4 Principles of analysis

5.1.4.1 Verification shall comprise the following:

— ultimate limit states analysis;

— fatigue limit states analysis;

— stability limit states analysis: i. e. bar buckling, plate and shell buckling;

— if required, verification of deformation limit states;

— verification of safety against overturning, sliding and lifting off;